Macroeconomics with Heterogeneous Agents and Input-Output Networks (*Baqaee & Farhi*)
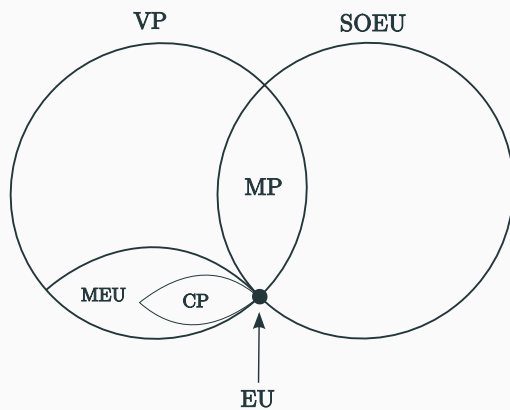
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A framework for understanding micro to macro elasticities

- Rich production sector
  - General input-output production
  - Flexible factors (elastic supply)
- Rich demand sector
  - Heterogeneous agents
  - General homothetic preferences

A framework

- The model to end all the others?

- General formulas for interpreting reduced form empirical estimates

After Hulten, understanding the symmetry in input-output elasticities

- Parsimonious sufficient conditions for symmetric propagation

$$\frac{d\lambda_j}{d\log A_i} = \frac{d\lambda_i}{d\log A_j}$$

- Useful to understand deviations from symmetry
  - Support in the data?
  - How important is understanding deviations for propagations of shocks

Making sense of reduced form estimates

Macro literature use micro-level estimates

- Use micro level data where it is possible to estimate (causally) impact of a shock (treatment)
  - See Mian & Sufi, Chodorow-Reich, Chaney, Sraer & Thesmar
- How do we extend our micro-level estimates to the aggregate impact
- We would like to go from:
  - *What is the impact of rise of housing collateral at household level?* (Mian & Sufi)
  - *What is the role of financing constraint for firms investment?* (Chaney, Sraer & Thesmar)
  - *What is the role of local banks being constrained on local employment?* (Chodorow-Reich)
- To the following general statements
  - *How does the rise in housing prices caused the financial crisis?*
  - *What explains the dramatic increase in aggregate unemployment during the crisis?*

Micro-level estimates are local treatment effects

- Important assumption: independence of treated units
  - shock to firm A has no impact on firm B
- Why what might be a good idea in clinical trials does not necessarily hold for macroeconomics
  - It is probably a good thing: a sign we are looking at an elasticity that matters for the aggregate
- General equilibrium effects; local productivity shocks affect other non-local parts of the economy
  - Aggregate prices respond to shocks and are an input to decision of all market participants
  - Linkages between production units (input-output)

Proposition 3 (and 5)

- General formula for elasticity of firm output to sectoral shock

$$\frac{d\log\Lambda}{d\log A_k} = \Gamma\frac{d\log\Lambda}{d\log A_k} + \Theta\frac{d\log\Lambda}{d\log A_k} + \delta_{(k)}$$

- δ is the reduced form elasticity, aka the first round response of output to the local shock
- Γ is the share propagation matrix: it depends on the structure of the production in the economy, I-O matrix, substitution across goods ... (Baqaee & Farhi 2017)
- Θ plays a role in heterogeneous agents economy: how a change in factor prices affects changes in income distribution and in turn affects aggregate factor demands

Practical examples

Barrot & Sauvagnat (2016)

- Estimate elasticity of substitution across suppliers using exogenous shocks (hurricanes) on individual suppliers:

$$\Delta \log \left(\lambda_i/\lambda_j \right) = \delta \cdot \Delta \log A_j + \varepsilon \qquad \text{(B\&S)}$$

- Simple CES world with elasticity θ we have

$$d\log(\lambda_i/\lambda_j) = (\theta - 1) d\log p_j$$

- If A_j only moves p_j then we can use (B&S) to estimate θ

- B&F show that if I have some mobile factor, the main input uses mobile M_i and fixed F_i labor as $L_i = M_i^{1-\beta} F_i^{\beta}$, then prices adjust and factors are reallocated and my response is amplified:

$$d\log(\lambda_i/\lambda_j) = -\frac{\theta - 1}{1 + (\theta - 1)\beta} d\log A_j$$

- If $\beta = 1$, I have an upward bias in my estimate

Do we look for a way to estimate β?

- Another instrument, another paper (similar issues potentially?)
- This is simplest example case: probably misspecified anyways
- Introduce heterogeneous agents from Proposition (5) and complexity in estimation (household mpc estimation) increases

What do we do?

- *"I know that I know nothing"* paradox
- How is this helpful for policy?
- Quote all estimates using bounds and do algebra with bounds (Manski)

Symmetric Propagation: $d_{A_i}\lambda_j = d_{A_j}\lambda_i$

- Venn diagram: extensive model allows to narrow down conditions which we obtain desirable properties
- Simple intuition: income redistribution effects when consumers have different exposure to factors (say high skill labor or low skill labor)
- Breaks condition of homotheticity in final demand across consumers

Why should we desire asymmetric propagation in models?

- Empirical support for asymmetric response? Is this a symptom or a final goal?
- Breaking asymmetry b/c markups vs. h.a.: leads to large deviations?
- Policy implications? (industry specific wedges, redistribution through consumer taxes)

What is not in the paper!

Unfair Criticism

- Probably a good idea to not have everything in the model
- Yet interesting to speculate on how to include missing elements in the framework
- Markups / Entry / Financial Markets

Markups

- Markups are exogenous
- Standard microfoundations from either
  - Monopolistic competition (Zehlobodko et al. 2012)
  - Strategic interactions (Atkeson & Burstein 2008)
- What gives?
  - Outside of Arrow-Debreu world?

How do we include entry in such model?

- Capital is simply an additional input
- How do we thing about including production units
  - Special factor that only exists on subset of state-space?
- Promising for policy analysis in growth models

. . .

- Great paper!
- Lots of intuition from abstraction on working of simpler class of models